

A METHOD FOR REMOTE SYSTEM PROCESS MONITORING*add a 1*

## Background of the Invention

The present invention relates, in general, to monitoring the performance of computer systems, and more particularly to a method for monitoring correct operation of computers remotely.

10 A network of computers typically includes several hundred individual computer systems each operating independently of all of the others. As the physical size and cost of an individual computer system decreases, so does the availability of full time staff to monitor the operation  
15 of the systems. At the same time more and more reliability is placed on the computer system and its software. A computer system may control any of a variety of tasks which must be performed twenty-four hours a day, seven days a week. Typical tasks are security for a building, operation  
20 of machinery, and electronic mail handling. It is not sufficient to rely on the users of the system to identify and report problems, problems must be detected internally and reported to the person who can take corrective action without requiring intervention of other human beings.

25 According to the prior art, monitoring the operation of a remote computer has required dedicated network services, some form of custom-made alarm system, or remote logon to the system to check for its status. A method typical of the prior art is described in the article "Big Brother: A  
30 Network Services Expert" by Don Peacock et al. published at the Usenix 1988 Conference in San Francisco, June, 1988. This article describes a method for remote logon to a computer system which is configured such that remote logon from a master computer is performed automatically as  
35 frequently as monitoring is required. Once the remote system logs on to the target system, monitoring programs are run and error messages either recorded or alarms sounded to

alert the operator of any problems. With the linking of many networks together network security becomes a major concern. Allowing automated logons to any computer which is connected to the network could also allow access by

5 unauthorized personnel. In addition the logon procedure is different for different types and versions of computer software. Of necessity then this automated logon is a complex and custom designed procedure which must be reprogrammed for every computer system for which monitoring  
10 is desired.

There is a need for a method to monitor the correct operation of a remote computer system without requiring a logon to that system. The method should allow a limited set of commands which would verify the desired operation without  
15 compromising computer security. It is also desirable that all commands be usable on a wide variety of different computer systems. In addition a high degree of customization must be allowed so as to monitor the important functions of a wide variety of computer systems.

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### Summary of the Invention

Briefly stated, the present invention provides a method  
25 for remote system monitoring which comprises two computer systems which operate independently but which are linked in such a way that they can exchange electronic mail with each other. An electronic mail message is sent between the computer systems which activates a monitoring program on the  
30 remote computer system. The monitoring program generates a status report which is returned to the monitoring computer by means of a second electronic mail message.

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### Brief Description of the Drawing

The single figure is a flow diagram which illustrates the major steps of a method in accordance with a preferred embodiment of the present invention.

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### Detailed Description of the Drawing

The single figure is a flow diagram which illustrates the major steps of a method in accordance with a preferred embodiment of the present invention. A monitor system 11 is linked to a remote system 12 by means of a network which provides electronic mail (E-mail) transmission. A typical computer network is a heterogeneous network which includes computers using a variety of different hardware and software for their operation. For example personal computers are often interconnected with UNIX workstations and large mainframes. Any of these systems may be designated as either monitor system 11 or remote system 12. The flexibility and the well defined interface which is achieved by using E-mail facilitates this required flexibility.

At a predetermined time monitor system 11 sends a network verify command 23 to a remote system 12. Remote system 12 responds with a network response 13. Typically network verify command 23 and network response 13 are low level network functions provided as part of the functionality of the network itself. This response serves to indicate that the network connection between monitor system 11 and remote system 12 is operational and that remote system 12 is actually running. Next a test of E-mail is performed 22 to ensure that the electronic mail service is operational. It is important to test the operation of electronic mail so that monitor system 11 does not send multiple messages to a disabled system. Such a condition causes a large number of messages to be queued for later

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delivery while waiting for remote system 12 to become operational. These queued messages can cause network congestion and can even delay or inhibit restart of remote computer system 12 if the volume of queued messages is sufficient. Accordingly, if electronic mail is not operational monitor system 11 sends no more messages but takes the appropriate corrective action such as notifying an operator. If electronic mail is operational, an E-mail reply message 14 is generated by remote system 12.

10       Upon receiving E-mail reply message 14, monitor system 11 generates a custom status request message which is sent 21 to remote system 12 by electronic mail. Receipt of this special message causes a status program to be run on remote system 12. The status program interprets commands sent 21  
15 by the E-mail message and generates a status message 16 in response. Status message 16 is returned 17 by electronic mail to monitor system 11. Monitor system 11 checks status message 16 against a custom list of processes which are expected to be running on remote system 12 and verifies  
20 other desired parameters such as disk space utilization. This information is then saved in a log file. If no urgent error messages are noted then no further action is performed. If required however the status is evaluated 19 and the operator notified 18 to take corrective action.  
25 Typically the notification process includes activating a call to a paging service which delivers a message to a pager held by the operator. The notification message identifies the host process and cause of failure to those receiving the monitor message. The monitor program also has a mechanism  
30 for problem escalation. If the failure is not resolved in a specified number of verification attempts, then another list of notifications to second and third tier operators can be sent as well.

35       By now it should be clear that the present invention provides a method to monitor the correct operation of a remote computer system without requiring a log on to that system. The method allows a limited set of commands which

verify the desired operation without compromising computer security. All commands are usable on a wide variety of different computer systems which comprise heterogeneous systems. In addition a high degree of customization is allowed which monitor the important functions of a wide variety of computer systems.